Borderline Industrial Injuries

J. L. BARRITT, M.D., San Francisco

• **Sometimes in cases of injury in which a claim for compensation is made on the basis that the injury is attributable to the claimant's work, the etiology is not clear cut. Such injuries tend to merge with and to overlap non-industrial ailments.**

This presentation deals with some of the more troublesome conditions of this order—among them chondromalacia of the patella, causalgia, Sudek's atrophy, shoulder-hand syndrome, whiplash injury, tenosynovitis, epicondylitis, acoustic trauma and acute coronary occlusion. Often in these conditions, it is almost impossible to determine accurately how much or how little of the associated disability is attributable to industrial cause. In most of them, however, early diagnosis and sympathetic management of injury when it does occur, are of great help in determining compensability and in returning the employe to suitable work.

ALTHOUGH THE MAJORITY of injuries that come before the California Industrial Accident Commission are more or less clear-cut clinical entities, such as sprains, lacerations, burns and fractures, there are others in which the cause is not always clear and the diagnosis is sometimes difficult. Frequently these injuries merge with or overlap non-industrial ailments so that the relationship of injury to the patient's work is debatable.

Some injuries of this kind involve special fields of medicine but the industrial surgeon is the one who first sees the patient. He is the one who must recognize the nature of the injury and direct the early treatment. Some of these borderline conditions have caused so much controversy and litigation that it would seem helpful to make note of them and to describe some of their usual clinical characteristics.

Chondromalacia of the Patella

In looking back over the records of many knee injuries which have come before the Accident Commission, it is apparent that the diagnosis of chondromalacia of the patella has been very frequently missed. This disorder tends to simulate so many types of knee derangement that the diagnosis is often made only in the course of an operation for repair of some other supposed condition.

Chondromalacia of the patella is quite common. Carr and Howard[3] reported 19 cases of this disorder in 60 consecutive cases in which knee arthrotomy was carried out. In ten of the 19 cases patellectomy was performed. These observers expressed belief that the cause of this condition is probably trauma and, secondarily, lack of blood supply and little regenerative power. The condition may be of idiopathic origin.[14] Symptoms may be precipitated by recurrent strains or by direct blows on the patella.[4]

The patient usually complains of pain, especially while climbing stairs. There is a feeling of insecurity and grating and sometimes pseudo-locking. Diagnosis may be difficult. Crepitation is the most common finding. The patient complains of pain when he extends his knee against resistance or when he tries to step up onto a chair. Firm pressure over the patella may cause pain. Quadriceps atrophy is usually present. Anterior-posterior x-ray views are seldom helpful but serial films made in tangential (axial) planes may occasionally reveal roughening or irregularity of the articular surface of the patella.

Often it is exceedingly difficult to ascribe the exact cause in cases of chondromalacia of the patella. Very often it occurs following trauma in arthritic persons who already have advanced degenerative changes in the knee. This and the tendency to simulate other knee disorders makes the evaluation of the industrial aspects difficult. Comparison with the opposite knee may give valuable information.

This condition is missed so frequently that it should be looked for whenever disability persists after an injury to the knee and findings of knee derangement of other types are lacking.

Treatment varies with the surgeon but will usually include quadriceps exercises. Excision of areas of diseased cartilage is advised by some surgeons. Patellectomy is a last resort.

The Reflex Dystrophies

Some of the disorders in this very troublesome group are reflex sympathetic dystrophy, causalgia, Sudek's atrophy and the shoulder-hand syndrome. The condition develops as follows: Following injury a painful local process initiates a reflex arc, probably by way of the sympathetic nervous system. The pain itself brings on vasospasm, which causes more pain, thus keeping up a vicious circle.[2] The various reflex dystrophies are not always clear-cut; they tend to merge and overlap. Each, however, does have certain individual characteristics.[5]

Presented before the Section on Industrial Medicine and Surgery at the 87th Annual Session of the California Medical Association, Los Angeles, April 27 to 30, 1958.

The stimulus which initiates the reflex arc is often a painful sprain, laceration, crush or infection. The symptoms and findings are out of all proportion to the original injury. Typically they consist of pain, swelling, edema, vasospasm, hyperesthesia and paresthesia. The skin is usually smooth and glossy and the skin wrinkles appear to be ironed out. The skin may be dry or there may be profuse sweating. The pain and swelling cause immobility. The immobilization in the presence of high protein edema fluid gives rise to fibrosis,[2] joint stiffness and deformity. In the early stages, pain, edema and hyperesthesia predominate, followed later by joint stiffness, deformity, atrophy and osteoporosis.

Causalgia. Causalgia is a form of reflex dystrophy. Pain is a basic feature in all the dystrophies but in causalgia it reaches its greatest intensity. The patient may not even permit the examiner to touch the injured member. The pain is usually more or less confined to areas supplied by the median or the sciatic nerve. Causalgia may result from relatively minor injuries. Infections and crush injuries of the fingers are frequent causes. The condition should be looked for in cases wherein tying, typing symptoms develop that are far out of proportion to the original injury, especially if the patient is of unstable type.

Sudek's atrophy. In Sudek's atrophy, while the general findings of the other types of reflex dystrophy may be present, it is osteoporosis that is the predominate feature. The condition seems to be often a sequel of painful unsplinted injuries. Joint stiffness and deformity are common residual conditions associated with it.

Shoulder-hand syndrome. Shoulder-hand syndrome is characterized by pain and stiffness in the shoulder and may or may not be associated with pain and swelling in the hand.[5] It is a type of reflex dystrophy and while trauma is a frequent cause, sometimes there may be no causative factor apparent. Steinbocker[26] reported a series of 42 cases, nine of which followed myocardial infarction. Among the other causes were trauma and hemiplegia.

The pain and stiffness in the shoulder may simulate that of bursitis or arthritis. It may be difficult to decide whether it was the injury blamed by the patient or some other, perhaps non-industrial, factor that was the cause. The disorder usually runs a rather chronic course and residual stiffness in the hand and shoulder are common.

Shoulder-hand syndrome seems to have become something of a dumping group for upper extremity ailments in which the diagnosis is in doubt. In borderline cases of shoulder disease in which the patient has been seen by a succession of examiners, one of the diagnoses is usually shoulder-hand syndrome.

Treatment of all the dystrophies should include an attempt to eliminate edema in the hope of lessening the subsequent fibrosis. Usually an attempt is made to break the reflex arc either by sympathetic block or, as a last resort, by sympathectomy.[15]

The various kinds of reflex dystrophy seem designed to plague the soul of the industrial surgeon. The findings are often vague and indefinite. Although the hyperesthesia and paresthesia are not always in accord with nerve distribution and may seem to be glovelike, hysteria may not be the primary factor.[2] The reflex dystrophies are frequently associated with non-industrial ailments. To make matters worse, these conditions usually occur in persons who are emotionally unstable.

A busy surgical consultant, recognizing the neurotic background, may be tempted to underrate the complaints. The patient may be sent to a succession of consultants in various fields, and each of them may add a little to the diagnosis and treatment. This cannot but confuse the patient, who, his underlying emotional problem unrelieved, finally returns to haunt the reception room of the industrial surgeon whence he began. Gradually the complaints diminish, but severely disabling stiffness and deformity remain. Although professing no solution to the reflex dystrophy problem, the author believes that early diagnosis, together with sympathetic management by a physician who has the patient's confidence, will prevent some of the disability.

Whiplash Injury

Whiplash injury is caused by violent hyperextension of the cervical spine followed by violent hyperflexion. The occupant of an automobile may receive injury of this kind when the car in which he is riding is struck from behind by another car.

The typical symptoms include neck pain and stiffness, with occipital pain which may radiate to the frontal region and to the eyes.[2] These symptoms may be associated with dizziness, faintness and vague vasomotor phenomena. The symptoms, while seemingly bizarre, do form a very definite pattern which is observed repeatedly. The symptoms are hard to explain. Question often arises as to whether or not the patient is actually disabled. Muscle spasm if present may be the only objective finding. X-ray examination may detect muscle spasm that cannot be observed otherwise.

All the spinal nerves except the first and second cervical pass out from the cord through intervertebral foramina and are more or less protected from injury. Since the nerves of the first and second cervical vertebrae pass out directly between the atlas and the skull and between the atlas and the axis, they would seem to be somewhat vulnerable to injury.

The posterior ramus of the second cervical nerve continues out through the muscles of the neck to become the greater occipital nerve, and symptoms referrable to the greater occipital are common after whiplash injury.

The anterior rami of the first, second, third and fourth cervical nerves make up the cervical plexus.[6,8] Each fiber connects with the cervical sympathetic ganglion by way of the gray rami. Deep branches connect with the vagus and hypoglossal nerves, and vasomotor fibers extend to the internal and external carotid arteries. Pizon[22] stated that even slight trauma to the cervical region may bring about changes in the blood vessels, especially the vertebral artery. He expressed belief that the vertebral artery is exposed to the "stretch syndrome" produced by irritation of the sympathetic nerves.

Since there is, then, a complex nerve network located in an area that is quite vulnerable to trauma, it seems probable that many of the bizarre symptoms associated with whiplash injury do have a definite organic basis.

Symptoms referrable to whiplash usually clear up within a year or 18 months, leaving little if any permanent disability. Heat and cervical traction seem to help in some cases.

Since whiplash injury may be confused with arthritis of the cervical spine or with injury to the cervical discs, the advice of a neurologist is usually indicated.

The term whiplash injury is frequently misused. Many trivial cervical sprains are spoken of as whiplash injuries and fantastic claims of disability are not uncommon. On the other hand, some attorneys, some general physicians and even some neurosurgeons seem to feel that every person claiming whiplash injury is a malingerer. Considerable study is being given to this problem, and it is hoped that a more scientific explanation for the bizarre complaints will be found.

Tenosynovitis

The kind of tenosynovitis most frequently observed by industrial physicians involves the extensor tendons of the thumb and wrist. The condition may follow any excessive gripping action. Knot- and even very light repetitive motion may be the cause. In early stages there may be no objective symptoms and the condition is often diagnosed as arthritis or neuritis.[11]

If the patient immediately ceases the offending activity, quick recovery is the rule. But if tenosynovitis is permitted to develop until objective findings are unmistakably present, it will probably be too late to prevent prolonged disability. Even at this stage, however, immobilization in a cast may be all that is necessary. Heat and diathermy seem to aggravate the condition. If severe symptoms persist over a month, surgical splitting of the involved tendon sheath should be considered.[11,12]

The problem is primarily one of early diagnosis, which is made on the basis of the history and the complaint of pain when the involved tendon is subjected to stretching. If the patient is a woman—and most patients with this disease are—she will almost always complain that she "drops things." If the tendons of the abductor policis longus and extensor policis brevis are involved, Finkelstein's test[13] is of great value. In this test the patient clenches the fist over the thumb while the examiner forces the wrist sharply into ulnar deviation. Complaint of sharp pain when this is done is practically diagnostic.

Although in most cases it is tendons in the upper extremities that are affected, sometimes tenosynovitis of the sheaths of the peroneal tendon follows ankle injury. In most such cases observed by the author, there was prolonged disability until someone along the line finally made the diagnosis. Usually in tenosynovitis that is sequel to injury of the ankle there is a sharply defined tender swelling just below and behind the lateral malleolus.[19]

Epicondylitis (tennis elbow)

In this condition there is usually tenderness in and around the epicondyle. The complaint of pain on extension of the elbow while the wrist is flexed is a valuable sign. There are seldom any objective findings.

The exact nature of the lesion of epicondylitis is not known.[25] It probably consists of fascio-periostitis[2] together with a partial tear of the fibers of the conjoined tendon at its point of origin near the epicondyle. The extensor carpi radialis is said to be commonly involved.[25] A much less common variation, with much the same symptoms, results from a bursitis of the radio-humeral bursa.[25]

Treatment of early cases consists of rest and avoidance of the work that brought the condition on. Later if symptoms persist, procaine injection may be tried, but usually this does not help much. Severe cases are probably best treated by converting the partial tear into a complete tear, either by manipulation or by surgical operation. The author knows of one orthopedist who simply injects procaine into the painful area and then instructs the patient to use the wrist and forearm vigorously. The results seem to be better than those obtained by other means.

Acoustic Trauma

The loss of hearing resulting from noise is becoming more and more an industrial problem. The deafness is of the "nerve type" and the high frequency

ranges of the sound spectrum are involved first. If associated with a history of noise exposure, diminished hearing acuity of sounds above 4000 cycles per second is strongly suggestive of acoustic trauma. The hearing loss due to the aging process (presbycussis) also is in the high frequencies.

Often in industrial cases of diminished acuity of hearing there have been no pre-employment audiograms and it is impossible to determine just what portion of the hearing loss is the responsibility of the present employer. Hence, pre-employment audiograms are advisable if there is a noise exposure. In some respects the acoustic trauma problem is similar to the silicosis problem, in that a succession of employers may be involved. The services of an otologist are always needed in dealing with such cases. The industrial surgeon, however, may be able to detect early cases and prevent the continuance of dangerous exposure.

Acute Coronary Occlusion

There are two entirely different schools of thought regarding the relationship of acute coronary occlusion to effort and to strain. Most authorities agree that in most cases coronary occlusion is a result of the natural progression of coronary disease.[7,9,10,18] Other investigators believe, however, that in some cases exertion and strain do precipitate the attack.[1,7,9,20,21,23,24,27] A few physicians seem to feel that exertion and strain play little or no part in acute coronary occlusion.[16,17] It seems doubtful, however, that even they would advise a patient with advanced coronary disease to do strenuous work.

Attorneys for injured workmen and attorneys for employers alike soon become very adept in choosing internists and cardiologists whose opinions, while perfectly honestly given, do nevertheless support their clients' contentions.

The picture of a workman collapsing from a heart attack during strenuous work is very impressive to most laymen. In many cases courts and boards reviewing compensation claims seem to have ignored the fact that every case of heart disease is different from any other. They seem to have been inclined to oversimplify the multitude of medical problems involved and to have based their decisions largely on time relationship and on the precedent of past decisions. If litigation does not begin until months or even years after the attack the details of events immediately preceding the attack are often vague. The more complete the history in these cases the more correct the final evaluation will be. Autopsy reports are usually helpful.

Rules against the hiring of persons with heart disease are not necessarily the answer to the problem as it affects employers. For one thing, making such rules would deprive employers of many highly skilled workers; and, for another, it cannot be overlooked that in most cases in which compensable cardiac disability is claimed, the attack occurs in a person who previously had, supposedly, normal heart. A well managed job placement program based on accurate medical evaluation of the ability to work is advisable, not only because it would enable many highly skilled men to safely return to work, but in the event compensation is claimed on the basis of cardiac damage, the adjudicating commission or board will have sound data for making a correct apportionment of disability.

California Industrial Accident Commission, 965 Mission Street, San Francisco 3.

REFERENCES

1. Boaz, E. D.: Angina pectoris and cardiac infarction from trauma or unusual effort, J.A.M.A., 112:1887, 1939.

2. Bunnell, S.: Surgery of the Hand, pp. 435-436, 654-657, J. B. Lippincott, Philadelphia, 1944.

3. Carr, C. R., and Howard, J. W.: Chondromalacia of the patella, Armed Forces Med. J., 3:185-197, February, 1952.

4. Cave, E. F., and Rowe, C. R.: Patella, its importance in derangements of the knee, J. Bone & Joint Surg., 32-A: 542-553, July 1950.

5. Cecil, R. L., and Loeb, R. F.: A Textbook of Medicine, pp. 1443-1444, W. B. Saunders & Co., Philadelphia, 1955.

6. Chusid, J. G., and McDonald, J. J.: Correlative Neuroanatomy and Functional Neurology, pp. 93-95, Lange Medical Publications, Los Altos, Calif., 1954.

7. Cooksey, W. B.: Exertion and coronary thrombosis, J.A.M.A., 113:351, 1939.

8. De Jong, R. N.: Neurologic Examination, pp. 743-744, Paul B. Hoeber Inc., Harper Brothers, New York, 1952.

9. French, J. A., and Dock, W. J.: Fatal coronary arteriosclerosis in young soldiers, J.A.M.A., 124:1233, 1944.

10. Friedburg, C. K.: Diseases of the Heart, p. 1044, W. B. Saunders & Co., Philadelphia, 1951.

11. Lapidus, P. W., and Fenton, R.: Stenosing tenosynovitis of the wrist and fingers—report of 423 cases, A.M.A. Arch. of Surg., 64:475-487, April 1952.

12. Lipow, E. F.: Writer reports fifty cases of whiplash injury, South. Med. J., 48:1304-1311, Dec. 1955.

13. Lipscomb, P. R.: Stenosing tenosynovitis at radial styloid process, Ann. of Surg., 134:110-115, July 1951.

14. Luck, J. V.: Orthopedic rehabilitation, Air Surgeon Bulletin, 2:431, 1945.

15. MacCarty, C. S.: Painful conditions of the upper extremity, Journal-Lancet, 72:84-91, February 1952.

16. Master, A. M., and Jaffe, H. L.: Factors in the onset of coronary occlusion and coronary insufficiency: Effort, occupation, trauma and emotion, J.A.M.A., 148:794, March 8, 1952.

17. Master, A. M., Dack, S., and Jaffe, H. L.: Postoperative coronary artery occlusion, J.A.M.A., 110:1415, April 30, 1938.

18. Mortz, A. R.: Trauma stress and coronary thrombosis, J.A.M.A., 156:1306, Dec. 4, 1954.

19. Parvin, Lt. Col. R. W.: Stenosing tenosynovitis of the common peroneal tendon sheath, J. Bone & Joint Surg., 38-A:1352, Dec. 1956.

20. Patterson, J. C.: Capillary rupture with intimal hemorrhage as a causative factor in coronary thrombosis, Arch. of Path., 25:474, 1938.

21. Patterson, J. C.: Relation of physical exertion to precipitation of coronary thrombosis, J.A.M.A., 112:895, March 1939.

22. Pizon, P.: Reference in Year Book of Orthopedic and Traumatic Surgery, pp. 168-169, Year Book Pub. Inc., Chicago, 1956.

23. Siegler, L. H.: Cardiac disability and death caused by strain—problems in workmen's compensation, J.A.M.A., 154:294, Jan. 23, 1954.

24. Smith, F. M., Sauls, H. C., and Ballew, J.: Coronary occlusion, a clinical study of 100 patients, Annals Int. Med., 17:681, 1942.

25. Speed, Campbell and Smith: Campbell's Operative Orthopedics, p. 1258, Vol. II, C. V. Mosby Co., St. Louis, Mo., 1951.

26. Steinbocker, O.: Shoulder-hand syndrome, Amer. J. of Med., 3:402, October 1947.

27. Yater, W. M.: Coronary artery disease in men eighteen to thirty-nine years of age, Am. Heart J., 36:334, 481, 683, 1948.

For Your Patients—

About the Cost of Good Medical Care...

While I know you understand that I, as your personal physician, am not in complete control of all medical care costs, I still would like to emphasize a few facts:

From your own experience you know that not-so-serious cases usually involve nothing more than the moderate expense of home or office visits and medication.

It is when serious illnesses or accidents require hospitalization that we may run into financial problems. Hospital charges, special nurses, drugs and appliances are all factors over which I have no *direct control.*

That is why it is my sincere hope that, should the need ever arise, you'll look upon me not only as your personal physician but also as a sort of "health engineer." In that capacity I am at your service to assist you in making arrangements for the best of medical care on the most reasonable financial basis possible.

I take those precautions when I am ill or when a member of my family requires extensive care. The same services are available to you.

Sincerely yours,

_____, M.D.

MESSAGE NO. 6. Postcard size, single fold leaflets, you to fill in signature. Available in any quantity, at no charge as another service to CMA members. Please order by Message No. from CMA, PR Dept., 450 Sutter, San Francisco.